DEIF

-power in control

DESCRIPTION OF OPTIONS

MIC-2 I/O module user's manual

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Document no.: 4189320032B

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Please read this manual carefully before installation, operation and maintenance of the MIC-2 multi-instrument.
The following symbols are used in this user's manual and on the MIC-2 multi-instrument:

High voltage symbol. Electrical hazard voltage can cause shock, burns or person injury or death. Failure to observe the information may result in injury or death.

Danger symbol. Observe the information after the symbol to avoid possible injury or death.

Installation and maintenance of the MIC-2 multi-instrument should only be performed by qualified, competent personnel trained and experienced in working with high voltages and currents.

This document is not fit for any untrained people. DEIF is not responsible or liable for any damages cause by improper installation and/or operation.

Content MIC-2

This manual describes I/O modules for the MIC-2, which can extend the MIC-2 functionality substantially.

Please read this manual carefully before operating or setting the MIC-2 to avoid unnecessary trouble..

Chapter 1 helps you understand the basic function and application area of I/O modules.
Chapter 2 describes installation and wiring of I/O modules in detail.
Chapter 3 describes the functions of I/O modules and parameter setting method.

1.1 The purpose of I/O modules MIC-2

The MIC-2 does not have any I/O functions itself, but it can realise multi I/O functions with I/O modules, such as digital input, counter of pulses, relay output, analogueue output, and analogueue input and so on.

There are three types of I/O modules, AXM-IO1, AXM-IO2 and AXM-IO3. A maximum of 1 communication and 2 input/output modules can be used for each MIC-2.

If two of the same I/O module types are required, the second of them must use one of the following DEIF numbers:

AXM-IO1 (2) - DEIF no.: 1211020018

AXM-IO2 (2) - DEIF no.: 1211020019

AXM-IO3 (2) - DEIF no.: 1211020020

The AXM-IO1 module, which is adapted to low voltage power distribution, is composed of:

- 6 digital inputs (DI), each digital input can be used to detect remote signals, or be used as a counter of input pulses. When it is used to detect remote signals, it can also enable SOE (sequence of events), recording the event and time of the event.
- 2 relay outputs (RO), it can work in controlling mode, or in alarm mode. Both of 2 relay outputs work in the same mode. When it works in controlling mode, it has two optional output modes, latching mode and pulse mode. When it works in alarm mode, it has one latching output mode only.
- 24V isolated power supply – used as an auxiliary power supply for digital inputs.

The AXM-IO2 module, which is adapted to factory DCS (or processing controlling, BA), is composed of:

- 4 digital inputs (DI), each digital input can be used to detect remote signals, or be used as a counter of input pulses. When it is used to detect remote signals, it can also enable SOE (sequence of events), recording the events and time of the events.
- 2 analogue outputs (AO), it can output analogue voltage or analogue current. When it outputs analogue current, the range of current is from 0 to 20mA or from 4 to 20mA. Please note that the functionality is limited.
- 2 digital outputs (DO), it can work in alarm mode, or work in energy pulse output mode. Both of 2 digital outputs work in the same mode. When it works in energy pulse output mode, it can output various types of energy.

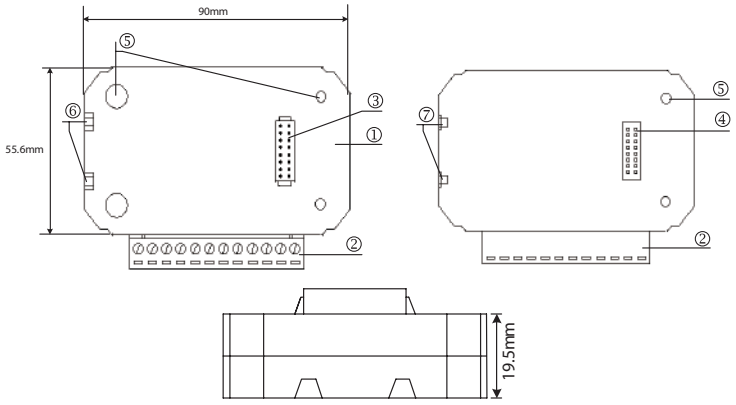
The AXM-IO3 module, which is adapted to electrical devices, is composed of:

- 4 digital inputs (DI), each digital input can be used to detect remote signals, or be used as a counter of input pulses. When it is used to detect remote signals, it can also enable SOE (sequence of events), recording the events and time of the events.
- 2 relay outputs (RO), it can work in controlling mode, or work in alarm mode. Both of 2 relay outputs work in the same mode. When it works in controlling mode, it has two optional output modes, latching mode and pulse mode. When it works in alarm mode, it has only one latching output mode.
- 2 analogue inputs (AI), the MIC-2 can detect currents ranging from 0 to 20mA or 4 to 20mA.

Extensibility: by linking I/O modules, MIC-2 can extend variable I/O functions.
Practicability: IO modules can be easily linked to MIC-2.

Functions	AXM-IO1	AXM-IO2	AXM-IO3
Detection of remote signals	✓	✓	✓
Recording of SOE	✓	✓	✓
Counting of input pulses	✓	✓	✓
Output remote controlling by relay	✓		✓
Output alarm by relay	✓		✓
Output alarm by digital output		✓	
Output power pulses by digital output		✓	
Analogue output		✓	
Analogue input			✓
24V isolated voltage output	✓		

Figure 2-1 shows a structure configuration of I/O module.



①	Enclosing	⑤	Installation screw
②	Wiring terminals	⑥	Counterpart of clip
③	Linking pins	⑦	Installation clip
④	Linking socket		

Figure 2-1 structure configuration of I/O modules

Environment
Please check the environment temperature and humidity to ensure they fall within the MIC-2 and optional modules requirement before installing the unit.

Temperature
Operation: -25°C to 70°C
Storage: -40°C to 85°C

Humidity
5% to 95% non-condensing.

Position
The MIC-2 and modules should be installed in a dry and dust-free environment. Avoid heat, radiation and high electrical noise sources.

Installation method
With the link pins, optional modules are linked to the MIC-2 and each other. The maximum number of extended modules linked to MIC-2, including I/O module, Ethernet module and PROFIBUS module, is three. The communication modules must be installed first. No other module can be installed before them.

Disconnect your MIC-2 from any live voltages and currents before following the below instructions!

1. Remove the Ext. Port protection lid.

1. Insert the installation clips in the counterpart of MIC-2, and then press the I/O module gently, so linking is established. Handle the installation with care to avoid damage to the optional module and/or the MIC-2 unit.

2. Tighten the installation screw.

3. Install other modules in the same way.

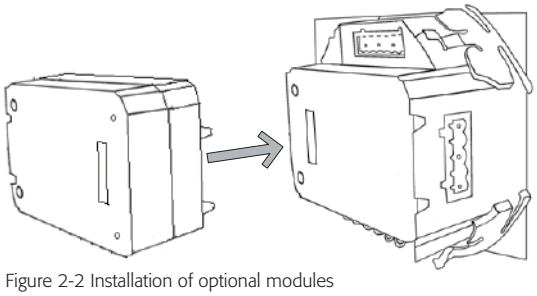


Figure 2-2 Installation of optional modules

Terminal strips of AXM-IO1 module:

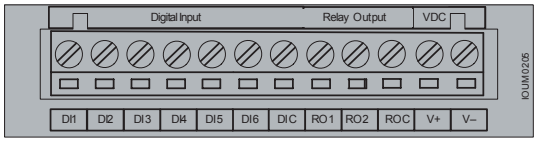


Figure2-3 Terminal strips of AXM-IO1 module

DI1 to DIC: digital input terminals, where DIC is the common terminal for DI1 to DI6 circuits.
RO1 to ROC: relay output terminals, where ROC is the common terminal for RO1 and RO2 circuits.
V24+ and V24-: auxiliary voltage supply terminals.

Terminal Strips of AXM-IO2 Module:

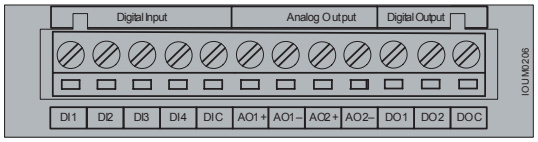


Figure2-4 Terminal strips of AXM-IO2 module

DI1 to DIC: digital input terminals, where DIC is the common terminal for DI1 to DI4 circuits.
AO1+, AO1-, AO2+, AO2-: analogue output terminals.
DO1 to DOC: digital output terminals, where DOC is the common terminals for DO1 to DO2.

Terminals strips of AXM-IO3 module:

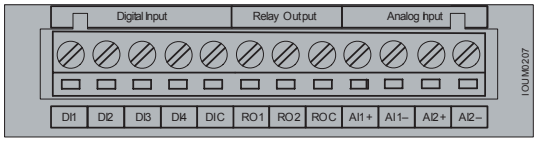


Figure2-5 Terminal strips of AXM-IO3 module

DI1 to DIC: digital input terminals, where DIC is the common terminal for DI1 to DI4 circuits.
RO1 to ROC: relay output terminals, where ROC is the common terminal for RO1 and RO2 circuits.
AI1+, AI1-, AI2+, AI2-: analogue input terminals.
Sequence of DI, RO, DO, AO, AI in I/O modules (according to the logical order in the communication address table of the main body):

DI Sequence:

AXM-IO11:	DI1-6
AXM-IO21:	DI7-10
AXM-IO31:	DI11-14
AXM-IO12 (if AXM-IO1 (2) is used):	DI15-20
AXM-IO22 (if AXM-IO2 (2) is used):	DI21-24
AXM-IO32 (if AXM-IO3 (2) is used):	DI25-28

RO Sequence:

AXM-IO11:	RO1-2
AXM-IO31:	RO3-4
AXM-IO12 (if AXM-IO1 (2)is used):	RO5-6
AXM-IO32 (if AXM-IO3 (2) is used):	RO7-8

DO Sequence:

AXM-IO21:	DO1-2
AXM-IO22 (if AXM-IO2 (2)is used):	DO3-4

AO Sequence:

AXM-IO21:	AO1-2
AXM-IO22 (if AXM-IO2 (2) is used:	AO3-4

AI Sequence:

AXM-IO31:	AI1-2
AXM-IO32 (if AXM-IO3 (2) is used):	AI3-4

Wiring of digital input circuit:

There are 6 digital input circuits, 4 digital input circuits and 4 digital input circuits in AXM-IO1, AXM-IO2 and AXM-IO3 modules respectively. The digital input circuit can be used to detect remote signals, or be used as a counter of input pulses.

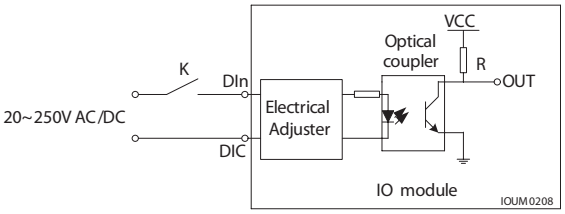


Figure 2-6 schematic diagram of digital input circuit

The circuit drawing of the digital input is simplified as figure 2-6. When K is switched off, OUT is in high state. When K is switched on, OUT is in low state.

Auxiliary power supply for the digital input is 20-250V AC/DC. The max current in the loop line is 2 mA.

The wire of the digital input should be chosen between AWG22~16 or 0.5~ 1.3 mm^2.

Wiring of relay output circuit:

There are 2 relay output circuits in AXM-IO1 and AXM-IO3 modules respectively. The relay output circuit can work in controlling state or in alarm state. In controlling state, it has two optional output modes, latching mode and pulse mode. In alarm state, it only has one latching output mode.

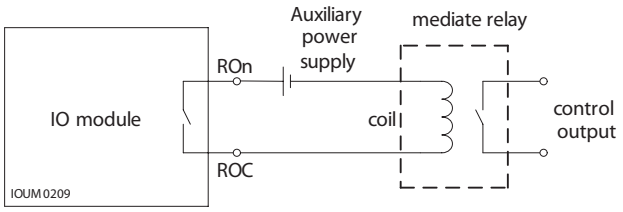


Figure 2-7 schematic diagram of relay output circuit

Relay type is mechanical Form A contact with 3A/250V AC or 3A/30V DC. A mediate relay is recommended in the output circuit as in figure 2-7. The wire of relay output should be chosen between AWG22~16 or 0.5~1.3 mm^2.

Wiring of digital output circuit:

There are 2 digital output circuits in AXM-IO2 module. The digital output circuit can work in alarm state, or work in energy pulse output state. Digital output circuit form is Photo-MOS. The simplified circuit is as figure 2-8.

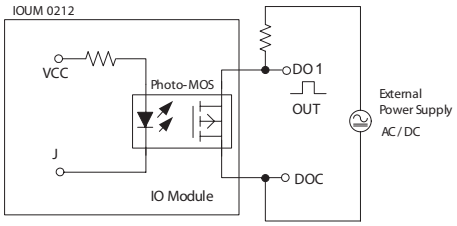


Figure 2-8 schematic diagram of digital output circuit 1

When J is in low state in figure 2-8, OUT is in low state. When J is in high state, OUT is in high state too. So OUT can output pulse signals under the control of J.
The max output voltage and current of digital output circuit are 250V and 100 mA respectively.

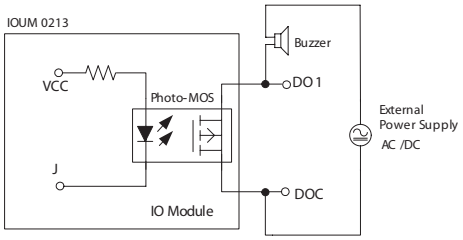
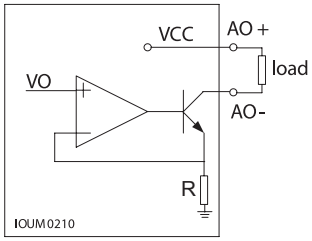


Figure 2-9 schematic diagram of digital output circuit 2

Another drawing of the alarming output with beeper is as figure 2-9.

The wire of digital output circuit should be chosen between AWG22~16 or 0.5~1.3 mm^2.

Wiring of analogue output circuit:
There are 2 analogue output circuits in AXM-IO2 modules. The terminals of the analogue output circuits are AO1+, AO1- and AO2+, AO2-. The analogue output circuit can convert anyone of 30 electrical quantities, which is selected by user. The analogue output circuit supplies 2 output modes, 0 to 20 mA mode and 4 to 20 mA mode.



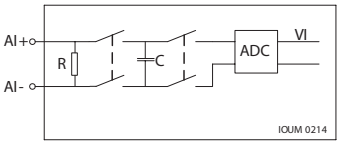
Current analog output

Figure 2-10 schematic diagram of analogue output circuit

The simplified circuit is as figure 2-10.

The load capability of analogue output circuit:
0 to 20mA mode: the max load resistance is 500Ω.
4 to 20mA mode: the max load resistance is 500Ω.

Wiring of analogue input circuit:
There are 2 analogue input circuits in AXM-IO3 modules. The terminals of analogue input circuit are AI1+, AI1- and AI2+, AI2-. The analogue input circuit supplies 2 input modes, 0 to 20 mA mode and 4 to 20 mA mode.



Current analog input

Figure 2-11 schematic diagram of analogue input circuit

The simplified circuit is as figure 2-11.

24V isolated power supply:
For the convenience of the factory field used, there is a DI auxiliary power supply provided in AXM-IO1 module. The voltage of the DI auxiliary power supply is 24V DC (1W). This power supply can not be used for other purpose.

Figure 3-1 shows the function of I/O modules, which is shown in the utility software as follows, where AXM-IO12 (AXM-IO1 (2) is used), AXM-IO22 (AXM-IO2(2) is used) and AXM-IO32 (AXM-IO3 (2) is used) are have been mounted on the MIC-2.

Figure 3-1 functions of I/O modules

3.1 Detection of remote signals

The digital input circuit can be set to detect remote signals.

1. Detection of remote signals
   When digital input circuit detects a qualified voltage input, it will show "1" on the screen and "ON" in utility software. Otherwise, it will show "0" on screen and "OFF" in utility software.

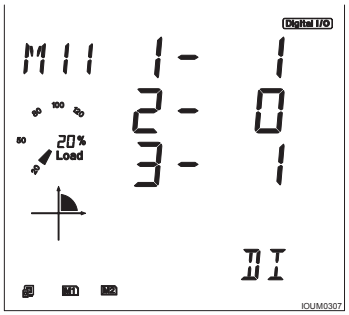


Figure 3-2 showing DI state on screen

2. Record of SOE
   When digital input circuit is set to detect remote signals, function of record of SOE can be enabled. So when the remote signals change, I/O module can record changing information, such as the time and the change.

   SOE Record: including "4399H to 4439H" address registers. "4399H to 4438H" address registers record 20 groups of SOE records. "4439H" records the I/O module which generates the SOE records. For example, if register "4439H" is 1, the 20 groups of SOE records are all generated by AXM-IO11.

   The 20 groups of SOE records are arranged based on time. When more than 20 groups of SOE records are generated, the records will begin at the first one.

   When the MIC-2 is powered on, the SOE records will begin at the first one. The data of SOE records will not be lost during power off. When the I/O module, in which the SOE function is enabled, is changed, the SOE records will be lost.

All groups of SOE records have the same data style. Take the first group of SOE records for example, "4399H to 439fH" registers record the time information, including year, month, day, hour, minute, second and millisecond. "43a0H" register records the state information, which is an unsigned integer, where bit 0 records DI1 state, bit 1 records DI2 state, and so on. For example, if "43a0H" is "1", it means that DI1 is "1", and others are all "0".

Note: If one of digital input circuits is set to be counter of pulses when the I/O module is SOE enabled, then the counterpart bit of "43a0H" register will always be "0".

Data of SOE records can only be read by the utility software, it can not be read on screen.

Figure 3-3 shows the data information of SOE records of AXM-IO12 (AXM-IO1 (2) is used) read by the utility software.

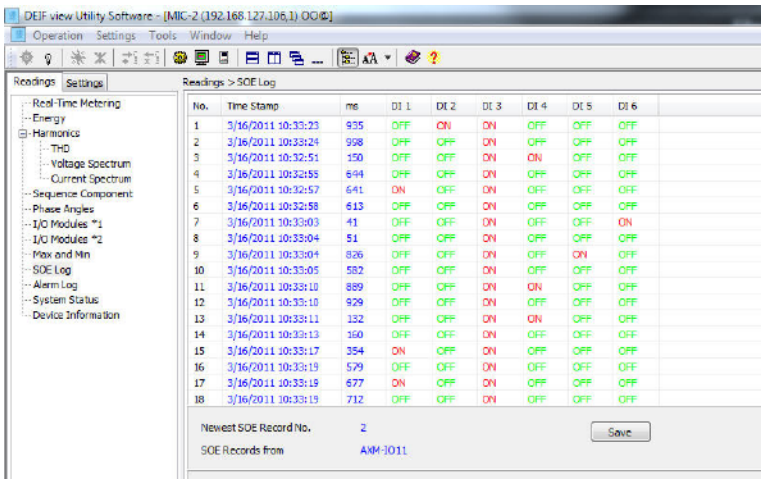


Figure 3-3 data information of SOE records read by the utility software

3. Parameter setting of detection of remote signals

Take parameter setting of AXM-IO11 for example.

"109eH" register: this register is an unsigned integer, where bit0 determines DI1's working mode, bit1 determines DI2's working mode, and so on. If the bit is "1", then the DI circuit is set to be counter of pulses. Otherwise, the DI circuit is set to detect remote signals. Figure 3-13 shows the parameter setting of digital input circuits.

"101bH" register: this register is an unsigned integer, it determines that which IO module will be SOE enabled.

If register is "0", then any IO module is SOE disabled.
If register is "1", then AXM-IO11 is SOE enabled.
If register is "2", then AXM-IO21 is SOE enabled.
If register is "3", then AXM-IO31 is SOE enabled.
If register is "4", then AXM-IO12 (AXM-IO1 (2) is used) is SOE enabled.
If register is "5", then AXM-IO22 (AXM-IO2 (2) is used) is SOE enabled.
If register is "6", then AXM-IO32 (AXM-IO3 (2) is used) is SOE enabled.

Only one I/O module can be SOE enabled at one time. If the I/O module is not linked to AcuivmII power meter, then it is meaningless to enable this I/O module's SOE function.

Figure 3-4 shows the parameters setting of I/O module's SOE function.

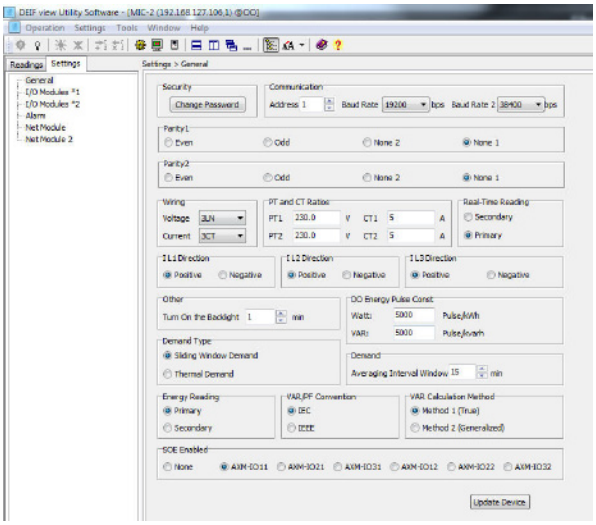


Figure 3-4 parameters setting of I/O module's SOE function

The digital input circuit can also be set to be counter of pulses.

Recorded number of pulses: including "4349H to 4380H" address registers. "4349H to 4380H" registers record 28 groups of number of pulses, including 6 groups of records for AXM-IO11, 4 groups of records for AXM-IO21, 4 groups of records for AXM-IO31, 6 groups of records for AXM-IO12 (AXM-IO1 (2) is used), 4 groups of records for AXM-IO22 (AXM-IO2 (2) is used) and 4 groups of records for AXM-IO32 (AXM-IO3 (2) is used) in sequence. One group of records is an unsigned long integer, for example, "4349H to 434aH" registers record the number of pulses for DI1 circuit of AXM-IO11.

Figure 3-5 shows the recorded number of pulses read on screen.

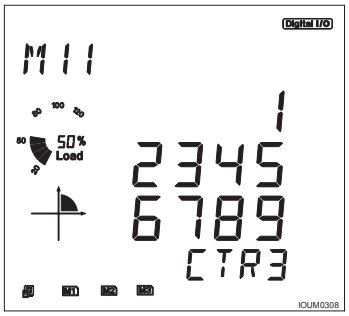


Figure 3-5 recorded number of pulses read on the screen

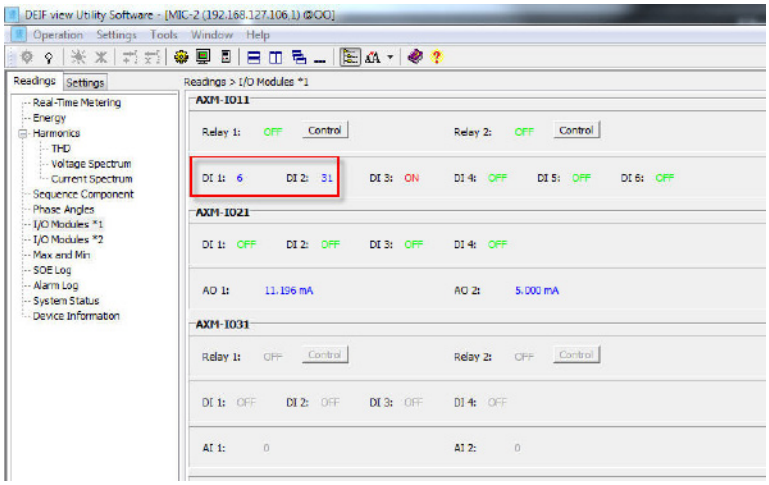


Figure 3-6 recorded number of pulses read by the utility software

Figure 3-6 shows the recorded number of pulses read by the utility software.

Parameter setting of counting of input pulses:

Take AXM-IO11 for example.

1. "109eH" register: if the bit is set as "1", the counterpart digital input circuit is set to be a counter of input pulses.
2. "109fH" register: this register is an unsigned integer. If this register is A, and the digital input circuit is set to be a counter of pulses, then the real number of pulses counted by this DI circuit will be as follow:

   real number of pulses = A × recorded number of pulses.

   For example, if A=20, the recorded number of pulses counted by DI1 circuit of AXM-IO11 is 100 (4349H to 434aH registers), then the real number of pulses is 20×100=2000.

The parameter setting is shown in figure 3-13.

Relays in I/O modules can work in two different modes, one is controlling mode, and the other is alarm mode. For controlling mode, relays can be switched on and off directly. For alarm mode, action of relays is controlled by whether the alarm is occurred or not.
There are two mode selections for relay output, one is latching, and the other is pulse. For the latching mode, the relay can be used to output two statues on or off. For the pulse mode, the output of the relay changes from off to on for a period time 'Ton' and then goes off. 'Ton' can be set from 50 to 3000ms.
Note: when relay is working in alarm mode, the default output mode is latching mode.

1. Display of relay state

If relay state is "ON", it means that relay is switched on. If relay state is "OFF", it means that relay is switched off.
Figure 3-7 shows the states of relays read on screen.
Figure 3-1 shows the states of relays read by the utility software.

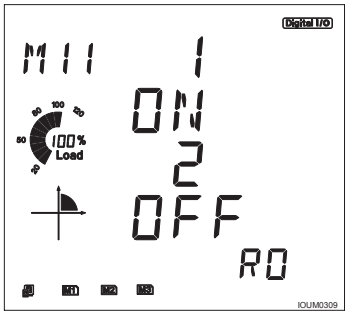


Figure 3-7 states of relays read on screen

2. Parameter setting

Take AXM-IO11 for example.

"RO working mode (10a0H)" register: this register determines the working mode of relays. If the register is "0", then RO1 and RO2 will work in controlling mode. If the register is "1", then RO1 and RO2 will work in alarm mode.

"RO output mode (10a1H)" register: this register determines the output mode of relays. If the register is "0", then RO1 and RO2 will work in latching output mode. If the register is "1", then RO1 and RO2 will work in pulse output mode.

"RO pulse width (10a2H)" register: when the relays are working in pulse mode, this register determines the period of time 'Ton' which can be set from 50 to 3000 ms. For example, if this register is "100", the relay (RO1 or RO2) will be switched on for 100ms after receiving ON instruction and then be switched off.

The parameter setting is shown in figure 3-13.

There are two mode selections for digital output circuit, one is alarm mode, and the other is energy output mode. For alarm mode, action of digital output circuit is controlled by whether the alarm is occurred or not. For energy output mode, digital output circuits can output various types of energy, such as import active energy, export active energy, import reactive energy and export reactive energy. When outputting energy pulses, pulse width can be set from 20 to 1000 ms. The minimum interval between two pulses is 20 ms.

Parameter Setting:
Take AXM-IO21 for example.

"DO working mode (10a5H)" register: this register determines the working mode of DO circuits. If the register is "0", then DO1 and DO2 will work in energy output mode. If the register is "1", then DO1 and DO2 will work in alarm mode.

"DO pulse width (10a6H)" register: when DO circuits work in energy output mode, this register determines the width of energy pulses.

"DO1 output type (10a7H)" register: when DO circuits work in energy output mode, this register determines the energy output type for DO1. If this register is "0", DO1 outputs nothing. If this register is "1", DO1 outputs import active energy. If this register is "2", DO1 outputs export active energy. If this register is "3", DO1 outputs import reactive energy. If this register is "4", DO1 outputs export reactive energy.

"DO2 output type (10a8H)" register: when DO circuits work in energy output mode, this register determines the energy output type for DO2. The value of this register is defined as the same as "DO1 output type" register.

"DO1 output type" register and "DO2 output type" register can be set to the same value or not.

The parameter setting is shown in figure 3-13.

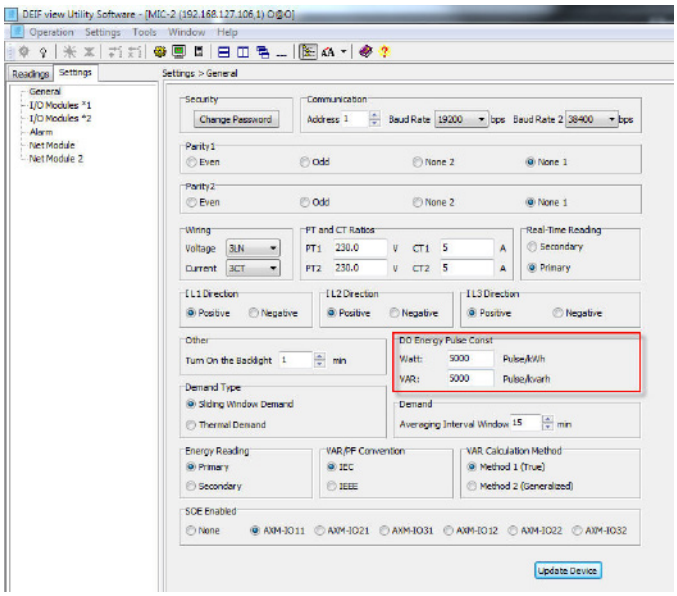


Figure 3-8 parameter setting of DO energy pulse constant

The DO Energy Pulse Constant refers to the numbers of pulses given on an amount of consumed energy (pulses/kWh). This consumed energy is the secondary energy which runs through the meter. This describes how to convert the pulses to pulses/kWh (primary energy):

E.g. DO Energy Pulse Constant (DOEPC) = 800; this means that you will have 800 pulses/kWh, namely, one pulse is 1/800 kWh (secondary side). The primary side pulse ratio; the DOEPC has to be multiplied with the PT and CT ratio.

E.g. PT1/PT2 = 230/230 = 1, CT1/CT2 = 150/5 = 30, one pulse will be 1/800 kWh * 1 * 30 = 30/800 = 0.0375 kWh => 26.67 pulses/kWh (primary side).

The same calculation with a DOEPC at 6000 will give 200 pulses/kWh (primary side).
In this example, a pulse setting range from 26.67-200 pulses/kWh (primary side) is possible.

1. Analogue output relationship with electrical quantities
   The analogue output circuit can convert anyone of 30 electrical quantities (reference to MIC-2 User's Manual), which is selected by user, to analogue voltage or current.

   The analogue output circuit supplies 2 output modes, including 0 to 20 mA mode, 4 to 20 mA mode.

   Figure 3-9 shows the relationship between analogue output and various electrical quantities.

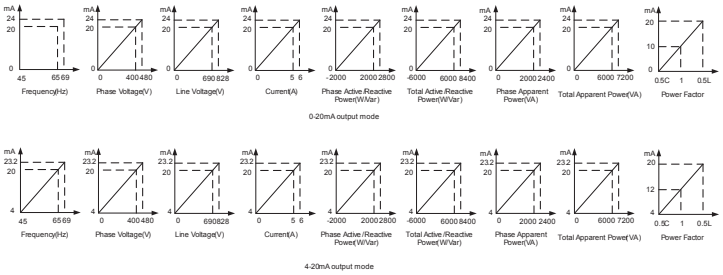


Figure 3-9 Relationship between analogue output and various electrical quantities

a> If the voltage input wiring of MIC-2 is 2LL or 3LL, then the analogue outpus relative to phase voltage, neutral current, phase active/reactive/ apparent power and phase power factor will always be 0.

b> The maximum of analogue output is 1.2 times the range, except when analogue output is relative to power factor.

c> Be aware that the power scales are based on a phase voltage (e.g. P = Up x Ip x CosPhi x 3).
This means that the voltage typed in, in the PT1/PT2 field (settings > general), must be the phase voltage.

2. Display of analogue output
   Value of analogue output is displayed in hex on screen. The relationship between displayed value and real value of analogue output is:

$$\text{Real value} = \frac{\text{Displayed Value}}{4096} \times 20\ \text{mA (current output mode)}$$

As shown in figure 3-10, the displayed value of AO1 is 0x0800, so the real value of AO1 is (0x800/4096) ×20 mA.

Figure 3-10 shows the displayed value of analogue output read by the utility software.

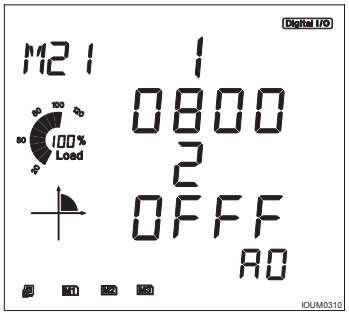


Figure 3-10 AO value read on screen

3. Parameter setting
   Take AXM-IO21 for example.

"Electrical quantities relative to AO1 (10c2H)" register: this register determines which electrical quantity AO1 should be relative to. It is explicated in the MIC-2 User's Manual. For example, if this register is "0", then AO1 is relative to "Frequency".

"Electrical quantities relative to AO2 (10c3H)" register: this register determines which electrical quantity AO2 should be relative to. The value of this register is defined as the same as "Electrical quantities relative to AO1 (10c2H)" register.

"Electrical quantities relative to AO1 (10c2H)" register and "Electrical quantities relative to AO2 (10c3H)" register can be set to the same value or not.

The parameter setting is shown in figure 3-11.

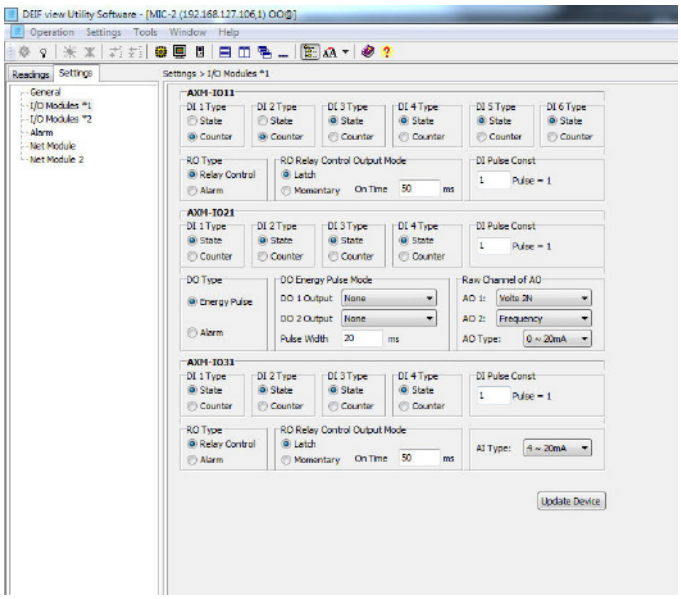


Figure 3-11 Parameter setting of I/O modules

1. Data dispose of analogue input

The analogue input circuits supply 2 types of input modes, including 0 to 20 mA mode and 4 to 20 mA mode.

Figure 3-12 shows the relationship between AI value and input analogue value.

AI value is ranged from 0 to 4095 without any unit. AI value is displayed in hex on screen.

Figure 3-13 shows the AI value read on screen.

Figure 3-1 shows the AI value read by the utility software.

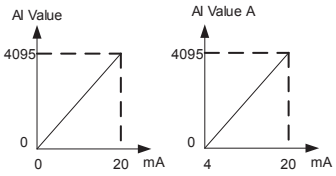


Figure 3-12 relationship between AI value and input analogue value

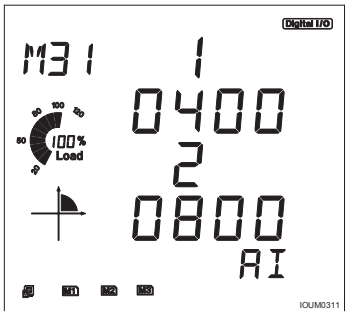


Figure 3-13 AI value read on screen